Chapter 14
Instrumentation

Closed Circuit Television (CCTV) System

The contractor shall be responsible for the detailed design, supply, installation, testing and commissioning and training of Employer's staff of Closed Circuit Television (CCTV) system to be installed in the ISPS PLC control room & at all locations in the plant on a minimum covering all units, entrance to the ISPS, along the boundary wall, storage facilities and other areas of the plant.

The CCTV system shall be designed to have complete coverage of the plants.

The scope shall include all necessary cabling, indoor & outdoor cameras and lenses, camera housing, TV monitor, control and interface units, coaxial cable transmission, video switching unit, time-lapse video recorders and tapes, junction boxes, power supplies, mounting brackets, etc, as required to provide a cost effective and reliable and fully operational CCTV system complying with the specification and to the approval of the Employer's Representative.

The CCTV system shall incorporate all equipment necessary to enable all areas to be viewed from the CCTV station monitor. The CCTV monitoring system shall be of latest design incorporating all the power and signal wiring as per manufacturer's standard. The system shall be complete package of one supplier of equipment, fixings, wiring conducting and all items necessary for a complete installation.

Materials Required

1. **Cameras**

Cameras shall be digital high resolution colour cameras having 1/3 inch CCD 450 TV lines with lens and an interlace of 2:1 in the scanning system of high excellent quality and performance utilising latest digital technology of super colour reproduction with low light high sensitivity down to 5 lux with electronic shutter speeds 1/50 to 1/30000 seconds .

Cameras shall be provided with a 14mm automatic lens with/without "drive" (amplifier) for 1/2" sensors, F1.4 CS mount, 22° angle shot and a composite video output at 75 ohms lines and the useful illumination range shall be 1.5 lux.The camera lens shall be of the auto iris zoom type with spot filter providing automatic control throughout the iris range from fully open F1.4, the lens shall incorporate a shutdown mechanism to protect the camera from high light level during periods of not in use. A neutral density filter designed to maintain image

detail and contrast shall be incorporated in the lens. The output signal shall be of PAL. The Camera shall be suitable for the specified environmental conditions.

The camera shall be provided complete with all accessories required. The camera shall have the following features.

1. Program modes 1.5, 3, 6 minutes;
2. Variable scan speed between 1.40° per second;
3. Programmable limit stops for auto/random/frame scan modes;
4. Series protocols BS-422 ‘P’ series and ‘D’ series;
5. Built-in menu system;
6. Pan movement – 360° continuous pan rotation;
7. Vertical tilt - Unobstructed +2 to +92°;
8. Variable pan/tilt speed controller;
9. Preset speeds:
Pan – 250°/sec
Tilt – 100°/sec
10. Electrical input – 24V AC.

2. **Monitor**

The monitor shall be of high resolution type suitable for CCTV system and shall comply with the following:
1. LED Screen: 32 dual monitor”;
2. Power Supply: 240V, 50Hz;
3. Resolution : 420 lines;
4. Bandwidth : 5 MHz (±3dB);
5. Video Input : 1 Vpp 75ohm;
6. Input/Output: BNC Video connector;
7. Front Controls: Power ON/OFF;
Brightness Control;
Contrast Control;
Color Control.

3. **Matrix Switcher**

The matrix switcher shall be micro-processor based and provide switching and control for 16 video inputs and up to 4 monitor outputs from any one keyboard. The unit shall be remotely operated by desk-top key boards or external computer Systems. The switcher shall have on-screen menu programming. The switcher shall support two system macros or salvo sequences to allow quick call-up of up to four cameras to four monitors simultaneously.

The salient features of the switcher shall be as follows:
1. 16 volts inputs; 2 or 4 video outputs;
2. 20-character camera title;
3. Time (24-hour or AM/PM formats), Date (4 formats);
4. Video inputs individually detectable for terminating or looping;
5. Individual monitor sequential switching with preset cell;
6. Compatible with RS 422 protocol;
7. Camera control selection;
8. Full duplex RS485 keyboard communications;
9. Selectable data port – RS 232/RS 422/RS 425;
10. Password protected menu programming;
11. User partitioning to prevent unauthorized viewing.

4. **Receiver**

The receiver shall operate on the principle of transmitting of transferring control information and video data on the same line. Standard control features shall include pan/tilt control, camera power, zoom lens control (zoom, iris, and focus

with adjustable speed).The receiver shall be compatible with control systems utilizing standard 15-bit command protocols. Auto random scan capability or preset positioning shall be possible.
The test local control module shall allow on-site testing of system functions.

The salient features of the receiver shall be as follows:
1. Input power – 240V 50Hz AC;
2. Control method – 15 pulse train superimposed on the video signal;
3. Pulse amplitude – approximately 1 Vp-p added to video signal, 333kHz nominal;
4. Connectors – two BNC connector for video input and output one 37pin
Amp CPC for control output;
5. Input video level – 1 Vp-p nominal, 2 Vp-p maximum;
6. System band width – Less that 2dB down at 10 MHz;
7. Fuse protection – 3 AG type;
8. Power chord – 3 wire grounded 18 AWG;
9. Operating distance – RG 11 at 1828 m;
10. Ambient temperature –20 to + 60°C.
The receiver shall be UL listed and shall comply with NEMA 4X and be CE compliant.

5. Amplifier

The video amplifier shall be of solid state circuitry and is meant for post equalization application only. The amplifier shall provide effective means of maintaining CCTV picture quality with RG11 coaxial cable.
The general construction of the amplifier shall consist of cover, chassis and panel.
The salient features of amplifier shall be as follows:
1. Input voltage – 240V AC;
2. Power transformer – 1.5VA (1.25 AMP) at 12 ±15% volts, 50Hz;
3. Input – Single BNC internally terminate in 75ohms;
4. Outputs – Single BNC source terminated;
5. Gain – Adjustable form 1 to 8dB;
6. Frequency response – Adjustable form flat (±1dB) at 12 MHz, greater than 18dB of boost at 12 MHz;
7. Output dynamic range – Up to 2 volts p-p at 50% APL;
Up to 1.5 volts p-p at 90% APL.
8. Cable length – RG 11 – 1828.8M;
9. Ambient temperature – 0° to 48.89°C at 0 - 90% RH.
The amplifier shall be UL listed to standard 2044 and comply with NEMA 1 and be CE compliant.

6. Time Lapse Video Cassette Recorder or Disk recorder

The time-lapse VCR/disk recorder shall be designed to suit multiple use. The recording capability shall enable continuous coverage over a long period of time with minimum tape changes.

Recording mode shall include standard VHS2 and 6-hour real time modes in addition to high density 18-hour linear real time recording. SP and EP recording modes shall make increase field recoding rate using standard high quality T120 VHS tapes.

The programming menu shall appear on the monitor output to provide easy setup of any programme feature. A lock mode shall disable all front panel controls presenting all changes to the unit's programming or operation. Playback features shall include speed search and reverse play back. Automatic alarm search feature shall allow the operator to go to a specific alarm index.

The salient features of disk recorder shall be as follows:

1. Standard VHS 2/6 hour recording mode;
2. 18/24/218/72/96/120/168 hour VHS compatible time-lapse modes;
3. Internal / short recording mode;
4. 24 hours real time recording mode;
5. High density record mode – triple speed time lapse recording;
6. Audio recording up to 24 hours;
7. Alarm index search;
8. Jog/shuttle for easy forward and reverse field playback and search;
9. On-screen menu programming;
10. Eight daily/weekly reading schedules.

7. **CCTV Integration**

A Close Circuit Television Camera's (CCTV) based on IP standard should be amenable to be integrated with the SCADA system.

Broadband internet services with high speed connectivity shall be used for data communication from CCTV monitoring locations to the CCTV server. The most suitable package of high speed broadband internet service provided by an Internet Service Provider (ISP) which suits the Client's requirement for high speed real time monitoring thru the CCTV shall be utilized. The contractor shall enter in to SLA agreement to provide continuous fail safe services as required under this contract.

27. **Approved Vendor/Manufacturer/Make List-CCTV**

The naming of a manufacturer in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired

CCTV systems	1. M/S SONY 2. M/s HITACHI 3. M/S YOKO INTERNATIONAL 4. M/s SANYO 5. M/S AVTEL 6. M/S MOBOTIX 7. M/S JMACS 8. M/S PYROTECH WORKSPACE

Surge Protection Devices

Surge protection devices (SPDs) shall be suitable for withstanding the surge arising out of high energy static discharge / lightning strikes and protect the

instrument to which it is connected against damage. SPDs shall provide protection through the use of quick acting semiconductors like Tranzorb, Zener diodes, varistors and an automatic disconnect and reset circuit. SPDs shall be passive and shall require negligible power for operation. During the occurrence of a surge it shall clamp on the allowable voltage and pass the excess voltage to the ground. The SPD shall be self- resetting to minimise the down time of the measurement loop.

SPD s shall be provided to protect devices transmitting and receiving analogue and digital signals derived from field devices located outdoors.

The surge protection device shall be rated for surge rating of 10 KA.

Surge Protection

Surge protection devices (SPDs) shall be provided at the control panel end of all instrumentation and control cables which run for distances in excess of 50 m outside the confines of the building in which the CP is housed. The SPD s shall be grouped in a specific area within the CP to ensure 'dirty' signal cables do not come into direct contact with 'clean' signal cables.

Cable trays and ladders

Cable tray, cable trays covers and cable-support ladders shall be of heavy-gauge galvanised steel and with an overall PVC coating when required to the approval of the engineer.

Cable tray and ladder systems shall be installed with joints and junction/bend pieces. Wherever tray and ladder sections are cut and shaped on Site, cut edges shall be dressed and painted with at least two coats of cold galvanising compound or lead-based anti-corrosive paint.

Ladder systems shall be secured to walls and ceilings by pre-formed galvanized interlocking channel.

All instrumentation cables shall be laid in separate cable tray with covers.

9. **Flexible conduits**

Flexible conduit shall be of the waterproof galvanised type of PVC wire-wound type with cadmium-plated mild steel couplings. Lengths of flexible conduit shall be sufficient to permit withdrawal, adjustment or movement of the equipment to which it is attached and shall have a minimum length of 300mm. Flexible conduit shall not be used as a means of providing earth continuity. A single earth conductor of adequate size shall be installed external to the conduit complete with earth terminations.

Where conversion from rigid conduit to flexible metallic conduit is to be made, the rigid conduit shall terminate in a trough-type box. The flexible conduit shall extend from this box to the equipment; the earth continuity cable shall be secured to the box and to the piece of equipment. The use of lid facing screws and the like will not

be permitted. Adaptors shall incorporate a grub screw or a gland to prevent the flexible conduit becoming loose.

10. PVC conduit

Where galvanised conduit would be liable to corrosion, PVC conduit shall be installed.

PVC conduit shall be of the oval or round high impact non-flame-propagating type as specified and self-extinguishing, to BS EN 61386-21. Surface and concealed installations shall be generally as described for steel conduit.
PVC conduit fittings shall comply with BS 4607. They shall all be white unless specified otherwise.

Jointing shall be carried out using PVC solvent and socketed accessories.

Expansion couplers shall be fitted in straight surface runs every 12m. The free end shall be sealed with non-setting mastic to form a waterproof seal.

Purpose-made bends may be used providing that the cable bending radius is maintained. Cracked or crinkled conduit will be rejected.

The conduit shall be suitable for use in ambient temperatures of between −5°C and +60°C and shall not be installed in areas that receive direct sunlight. A separate protective conductor (earth-continuity conductor) shall be installed.

Adaptable boxes and accessories shall be made from heat-resistant insulating material. The minimum wall thickness of boxes having a nominal internal depth of 16mm or less shall be 1.5mm. For deeper boxes, the minimum wall thickness shall be 2mm. All boxes which are intended to support luminaires or other heat sources shall have either external fixing lugs riveted to the metal inserts or utilize steel insert clips.